

(13) *Halictus pseudopectoralis*, sp. n.

♀. Length 7 millim. Black, shining; wings greyish. This so closely resembles the U.S. species allied to *pectoralis* that it will be only separated by a comparative description. The front above level of antennæ is closely punctured, as in the allied species. From *pectoralis*, Sm. (Illinois specimen, determined by Robertson), it differs by the darker wings, the somewhat broader face, the much less closely punctured mesothorax, the entirely black tegulæ, the more regularly wrinkled enclosure of metathorax, and the very distinct white hair-patches at lateral bases of segments 2 and 3 of abdomen. From *quadrifasciatus*, Rob., it differs by the somewhat darker wings, the larger head, the more sparsely punctured mesothorax, the black tegulæ, and the more strongly wrinkled enclosure of metathorax. From *pectoraloides*, Ckll., it differs principally in the strong regular longitudinal wrinkles of the metathoracic enclosure, but also in the darker wings and the brownish pubescence on the hind tarsi.

In its metathorax it resembles most *pectoralis*, in the sculpture of the mesothorax *pectoraloides*. The median impressed line of the mesothorax is very distinct.

Paso de Telaya, March 30; San Rafael, March 8 and 9. On *Bidens* and another composite.

Mesilla, New Mexico, U.S.A.,
Aug. 10, 1896.

XLV.—*Papers from the Gatty Marine Laboratory, St. Andrews.*—*On the Nephridia, Reproductive Organs, and Post-larval Stages of Arenicola.* By H. M. KYLE, M.A., B.Sc., Berry Scholar in Natural Science, University of St. Andrews.

[Plates XIII.–XV.]

WHILE endeavouring to work out the development of *Arenicola* I was naturally led to examine the nephridia and then the reproductive organs. Both of these have been described quite recently, by Cunningham in 1888 (4) and by Benham in 1891 (1), and in this paper I cannot do more than confirm their descriptions for the most part and add one or two points of interest.

On the sands of St. Andrews Bay and all round the coast *Arenicola* is got in great abundance and in all stages—from

the young transparent forms 3 to 4 inches in length to the older and larger of 14 inches and over. It is curious to notice how the external appearance of these larger forms varies according to the surroundings in which they live. From the clean bright gritty sand a form is got of a fine golden colour, with a smooth and glossy exterior, and exuding from its surface a gelatinous substance which is quite clear and transparent; from the muddy clay-flats another form is procured which has a rough and coarse appearance, is of a dark dirty brown colour, and gives off from its skin a green slimy gelatinous material.

From both of these forms the reproductive products may be obtained, and these may either be sperm-bundles or ova. The time of the appearance of these products is variously given by different writers, and, judging from my own observations, the animals seem to spawn during a period extending from January to September, though there is a cessation during April, May, and the first part of June. Temperature does not seem to be a determining influence, because in the height of midsummer (in July) specimens with ova were obtained at high-water mark, whilst in September similar specimens were found at low-water mark.

If the nephridium be dissected out from the side of the body and mounted, then the drawing of it given by Benham will be seen to be perfectly accurate. But this dissection implies the cutting of certain tissues around—the separation of the nephridium from the vascular system, the reproductive organs, and the oblique muscles. In the process of mounting also the nephridium is straightened out and its original form thus altered. For these reasons it seemed to me right to give still another drawing of the complete nephridium as seen *in situ*. Several other drawings of the complete nephridium have been given. Cosmovici's paper (3) came into my hands after my own had been completed, and my drawings agree with his more than with those of others. Cunningham's drawing, as well as his paper (4), is far too vague and indefinite to give one a proper idea of a nephridium. The drawing given by Vogt and Yung (6) agrees very closely with that of Cosmovici's, but the fringes on the dorsal lip of the nephrostome are not represented.

The fringes round the dorsal lip of the nephrostome are vascular processes connected with the branchial vessel. Benham describes these processes as if they were restricted to the lip of the nephrostome. In reality they are continued for a short distance behind the nephrostome over the neck; this can be seen both in transverse and longitudinal sections,

and Cosmovici's drawing shows it very well. They extend obliquely across the neck and end just above the posterior dilated part of the nephridium. From these blood-vessels pass into the tissue of the nephridium in all directions and posteriorly into the upper part of the gonad, which lies at the lower end of the neck.

The thin strips of muscles which stretch across the nephridium and bind it down to the side of the body have a slight attachment to these processes, but not to the nephridium; hence the neck of the nephridium can be moved about, and may be found lying parallel to the longitudinal axis of the body (Pl. XIII. fig. 1), or bent outwards so that it is almost at right angles to this axis, the nephrostome being then in a transverse plane (fig. 2). This movement is in all probability executed by means of the transverse strips of muscle through the connexion mentioned above.

The particular structure of the nephridium need not be more than mentioned, as Benham has fully described it, and the sections agree with his descriptions. The posterior dilated part, however, seems to be wholly glandular, without any muscular fibres. Such fibres appear as the dilated portion narrows between the longitudinal strands of muscle along the body-wall. To these strands the nephridium is in no way attached, and such points to the conclusion that the nephridium and the circular muscles are developed sooner than the longitudinal ones; and this finds further confirmation in that the nephridia and circular muscles, as Benham mentions, are present in the post-larval stages, whilst the longitudinal are hardly, if at all, evident.

Where the nephridium becomes connected with the transverse muscles muscular fibres are plentiful in its walls.

The canal to the exterior runs for a short distance round the body within the circular muscle-band, so that the external opening is controlled both by the muscles of the body-wall and by the muscular fibres of the nephridial wall. These latter are in reality but continuations of the circular fibres of the body-wall.

The nephridium of those with ripe products differs slightly from the normal, being more elongated and the walls thinner and more attenuated.

The reproductive organs (Pl. XV. fig. 5) can be found without much difficulty by means of sections of the nephridia—the second, third, and fourth pairs especially—of those animals which contain the genital products. Cunningham narrates that “loose cellular masses were often seen in the neighbourhood of the nephridia,” and that “these were traced to the cord of

cellular tissue . . . attached to the nephridium." This is correct, but longitudinal sections through the nephridia with the part of the body-wall to which they are attached show more. These cellular masses are then obtained in position, and their relation to the parts around made out. The drawing of a transverse section by Benham gives a good idea of their position and shows, moreover, that the cord of cellular tissue of which Cunningham speaks runs down from the ventral lip of the nephrostome and sustains the upper portion of the gonad, while from the dorsal lip at its posterior end a blood-vessel runs to the same place. But this is not the only portion of the gonad. Springing from the epithelium lining the body-wall other cellular masses may be seen, and it is to these, I think, that Cunningham refers, being larger and more obvious than the upper portion in direct connexion with the neck of the nephridium. These masses lie immediately below the posterior dilated portion of the nephridium, and seem to have no connexion either with each other or with the upper portion of the gonad. They seem to have arisen by simple infoldings of epithelium into the body-cavity, and present the appearance of a palmate leaf, the veins being represented by a tissue composed of elongated cells, whilst round the edges is the tissue giving rise to the ova or sperm-mother-cells. At the base of the gonad is a blood-vessel; this is a prolongation of the branchial artery, and runs up from these masses through the upper portion of the gonad to the posterior extremity of the vascular processes on the dorsal lip of the nephrostome. Hence this blood-vessel connects the different portions of the gonad with one another.

Small worms answering to the descriptions given by Benham (2) and by Ehlers (5) of the post-larval stages of *Arenicola* are obtained here in the deep-sea tow-nets during the spring. Although got later than those mentioned by Benham, they are really younger, the largest specimen being 5 millim. in length. They are most frequently obtained in April and May, but in the middle of June 1895 a single specimen, of length 3.5 millim., was procured. This shows that the spawning-period must be spread over several months.

The gelatinous tube which envelops the animal is of a strong yet flexible nature. The movements are executed by means of wriggling the tail from side to side like an eel, and the tube bends with every movement. The little worm is thus able to swim easily through the water.

The attempt to cut longitudinal sections of specimens having the investing tube was a failure, owing to the firmness

and elasticity of the tube, whilst those that were free were readily cut.

The animals were examined in the living state, and some interesting points noted. In none of them was there any sign of gills; otherwise they agreed with the description given by Benham. There were two kinds of ventral chaetae (Pl. XV. fig. 9), however—one with a single prong like that of the adult, but more curved, the other with two.

The vascular system was easily traced through the transparent body-wall, and was of a distinct red colour. The heart expanded and contracted regularly, the time between two complete expansions being 4·3 seconds. The digestive glands lying close beside the heart were doing the same, but not so regularly, and taking a much longer time—11 to 16 seconds. Of the blood-vessels the most distinct was the ventral, whilst there were two little red swellings ventrally—one near the mouth, the other about the fourth somite.

The nephridia appeared as simple elongated tubes.

In the head-region (Pl. XIV. figs. 11–13) there is very little sign of the pit on the dorsal surface of the prostomium which is present in the adult. In section a slight depression is noticed behind the position of the brain on the dorsal surface, and this may be a sign of the beginning of the formation of the pit.

The pharynx is muscular and the body-cavity round it is filled up by loose mesenchyme-cells, which are not compact enough to form a definite tissue, but nevertheless seem to be contractile. The pharynx seems to be eversible, as in the adult, because in the specimen from which the sectional drawing (Pl. XIV. fig. 12) was made the pharynx was folded back towards the mouth. The epidermal cells of the prostomium are elongated, cylindrical in form, with yellowish contents of a granular nature. All the epidermal cells covering the first two somites contain this granular matter.

Within the prostomium the mesenchyme-cells surround ventrally a large space, dorsally the supracœsophageal ganglion or brain. This brain, which has the appearance of "punct-substance," occupies a large portion of the interior of the prostomium. Dorsally it seems to be covered only by the mesenchyme-cells, and it looks as if the whole of this part were turned in to form the pit of the adult. Anteriorly nerve-filaments pass from the brain to end in the epidermal cells of the prostomium. Posteriorly in the median dorsal line scattered nerve-filaments pass backward, whilst at the sides filaments stretch to the otocysts and the commissures connecting the brain with the subcœsophageal ganglia. Ventrally

the brain is continued into one or two small protuberances, which project into the space lying above the mouth.

At the sides of the head immediately under the epidermal cells lie the otocysts, two in number. Each consists of a central cavity containing small, irregular, transparent bodies—the otoliths. There is a single layer of cells surrounding this cavity with very small cilia. This layer of cells, though quite distinct, is not so clearly marked off from the neighbouring tissue as in the adult, nor is it so compact or regular. In the adult the otocyst lies within the muscles of the skin and quite free from them; in this case it is close to the epidermis and is surrounded by the mesenchyme-cells. This mesenchyme-tissue is continued along the body-wall, and makes it difficult to distinguish between the longitudinal and circular muscles. The external layer of glandular cells is more highly pronounced than either of these muscle-layers.

The stomach—a long tubular organ—is lined by a single layer of cells, which are smaller than those of the gullet and other parts of the alimentary tract, and do not stain so deeply. The walls of the gut diverticula, which lie dorsally to the stomach, have small glands upon them which project into the lumen. These glands have a central vascular core with cells clustered round. The first part of the intestine consists of large cells, which are also glandular in their nature.

References.

- (1) BENHAM.—“The Nephridium of *Lumbricus*, with Remarks on the Nephridia in other Chaetopoda,” *Quart. Journ. Micr. Sci.* vol. xxxii.
- (2) BENHAM.—“The Post-larval Stage of *Arenicola marina*,” *Journ. Mar. Biol. Assoc.* 1893.
- (3) COSMOVICI.—“Glandes Genitales et org. segmentaires des Annél. Polychètes,” *Arch. d. Zool. exp. et gén.* viii. 1879.
- (4) CUNNINGHAM.—“On some Points in the Anatomy of *Polychætes*,” *Quart. Journ. Micr. Sci.* vol. xxviii.
- (5) EHLERS.—“Sur Kenntniss von *Arenicola marina*,” *Nachrichten von der königlichen Gesellschaft . . . zu Göttingen.* 1892.
- (6) VOGT and YUNG.—“Anatomie comparée pratique.” 1888.

EXPLANATION OF PLATES XIII.-XV.

Figs. 1 & 2. Nephridia in position :

- (1) where nephrostome is parallel to the long axis of the body ;
- (2) where nephrostome is inclined to this long axis.

a, fringed dorsal lip of nephrostome, the arrow points towards internal opening of nephridium ; *b*, thin, almost transparent part of the neck of nephridium ; *c*, dilated posterior portion, which contains amoeboid cells similar to those found in body-cavity, also a brown granular substance which seems to be the product of excretion from the cells in the central part of nephridium ;

d, main portion of nephridium, of a brown colour, due to granular matter in cells; *o.m.*, oblique muscles which bind down nephridium; *l.m.*, longitudinal muscles; *s*, notopodial bristle-sac; *n*, nerve-cord.

Fig. 3. Transverse section through nephrostome. *d*, vascular processes on dorsal lip, with excretory products between; *v*, ventral lip of nephrostome.

Fig. 4. Longitudinal section through nephrostome. *d* and *v* as above; *b.v.*, small blood-vessels which ramify over main portion of nephridium; *l.m.*, longitudinal muscles in body-wall.

Fig. 5. Longitudinal section to show reproductive organs. *d* and *v* as above; *c*, cord of cellular tissue running down from ventral lip of nephrostome to the upper part of gonad (*u.g.*), through which runs the blood-vessel (*b*); *p*, posterior dilated portion of nephridium; *p.g.*, posterior portions of gonad; *b.v.*, blood-vessels; *l.m.*, longitudinal muscles of body-wall; *t.m.*, transverse muscles; *gl.*, glandular layer of cells on external surface of body (hypoderm?).

Figs. 6-9. Drawings from live specimens of post-larval stages of *Arenicola*.

6. Anterior region. *m*, mouth; *p*, prostomium.

7. Four somites of body—fifth, sixth, seventh, and eighth. *h*, heart; *v.v.*, ventral blood-vessel; *g*, gut diverticula; *s*, stomach; *n*, nephridium.

8. Dorsal bristles.

9. Ventral bristles, of two kinds.

Fig. 10. Longitudinal section through portion of body. *o*, otocyst; *gl*, gullet; *g*, gut diverticula; *s.i.*, sacculated part of intestine; *h*, heart; *s*, stomach; *v.v.*, ventral blood-vessel.

Figs. 11-13. Sections through head-region. *s.a.*, supra-oesophageal ganglion or brain; *o*, otocyst; *m*, mesenchyme-tissue; *c*, nerve-commissure from *s.a.* to *sb.a.*; *sb.a.*, suboesophageal ganglion; *ph.*, pharynx.

11. Transverse section.

12 & 13. Longitudinal sections.

Fig. 14. Adult otocyst drawn for comparison with above.

XLVI.—On new small Mammals from the Neotropical Region.

By OLDFIELD THOMAS.

DURING the past six months several collections of small mammals from different parts of Central and South America have been received at the British Museum, and among these there are a certain number of new species, which may be conveniently all described in one paper.

GLYPHONYCTERIS*, gen. nov.

(Fam. *Phyllostomatidae*; group *Vampyri*.)

Nose-leaf narrow, bound down to the muzzle in front. Chin-warts apparently only two, one on each side of a central

* γλύφεω, to chisel.